

Strait of Juan de Fuca - Fish and Shellfish Resource Maps

The following draft maps were prepared by the Department of Fisheries (now Department of Fish & Wildlife) to represent nearshore fish and shellfish resources of high commercial, recreational, or ecological value. **Adult and juvenile life stages of a number of ecologically and economically important species including salmon, marine fish, baitfish, and shellfish as well as the plankton community are considered to be ubiquitous in distribution and therefore, are not displayed on maps.** Pertinent information on many of these species can be found in the habitat association and timing tables which include information on temporal and spatial distribution, preferred habitat, and relative abundance of various life history stages. This information must be considered in resource protection and damage assessment efforts.

Additional areas of resource occurrence are continually being documented. The extent of intertidal spawning habitat represented in the baitfish maps for surf smelt and Pacific sand lance is updated annually as new spawning areas are documented.

The shellfish maps do not offer complete information on intertidal and subtidal shellfish resources. Surveys run by the Department of Fish & Wildlife have been oriented to locating beds that could be commercially harvested. Many intertidal areas are privately-owned tidelands upon which the Department of Fish & Wildlife has not undertaken a comprehensive inventory of the naturally produced or cultured shellfish resources. No attempt has been made on these maps to differentiate between areas which have not been surveyed and those in which shellfish were not found in commercial quantities.

Due to a combination of new data and incomplete data, it is not safe to assume that blank areas on the maps are not of concern. If you have any questions regarding this information, please contact the Department of Fish & Wildlife Spill Response Unit at (360) 902-2568.

DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Pacific Herring (*Clupea harengus pallasi*)

Resource Information Mapped: Adult prespawning holding areas and spawning areas.

Resource Use: Human; roe-on-kelp and Port Gamble spawn-on-kelp fisheries, sport bait fishery targets juvenile fish. Non-human; one of the most important components of the marine food chain; they provide the link between primary production and upper level predators. All life history stages utilized as food by various predators including salmon, rockfish, lingcod, halibut, birds, marine mammals, etc.

General Location or Habitat Association: Adult prespawning holding areas are located in the Protection Island area between Sequim and Discovery Bays and in Discovery Bay. Fish are found in pelagic schools. In this region herring spawning occurs within Discovery, Sequim, and Dungeness Bays. Herring deposit their eggs on marine vegetation, such as eel grass or algae, within the shallow subtidal and intertidal zones.

Seasonal Sensitivity or Occurrence: Adult herring congregate in relatively distinct areas during December and January prior to spawning. Exposure of pre-spawning adults to oil can result in the accumulation of hydrocarbon compounds in the yolk of maturing eggs. Metabolism of these compounds during embryonic and larval stages can result in lethal and sublethal genetic, cellular and morphological injuries. Spawning occurs from mid-January through mid-April. Eggs hatch after approximately 10 days. Larvae and subsequent juvenile fish are found in nearshore areas throughout the summer following hatching. Eggs and larvae are highly susceptible to injury (lethal) from oil exposure.

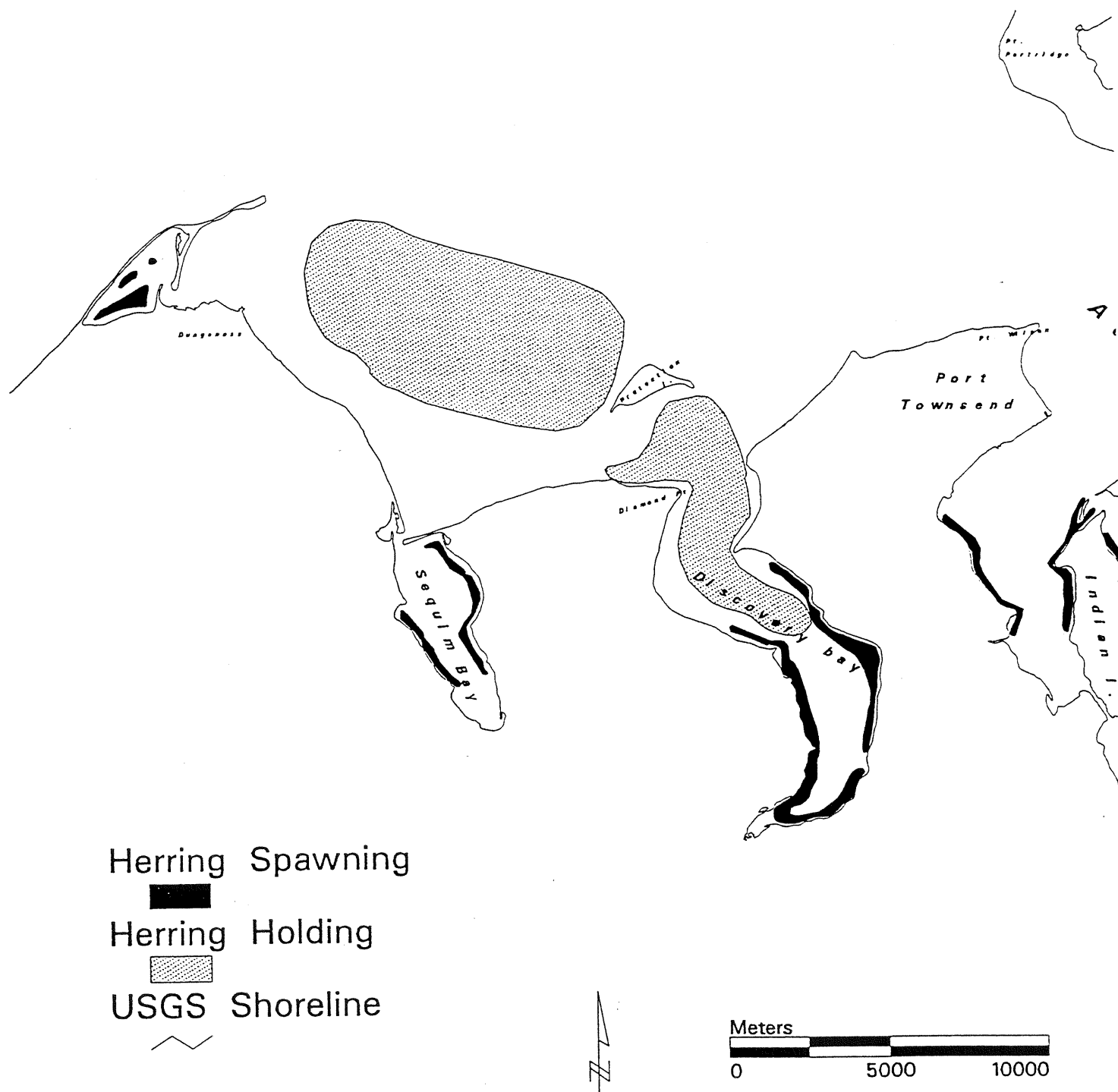
Recommended Protection Strategy: Keep oil out of Discovery Bay, Sequim Bay, and Dungeness Bay.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

- Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.
- Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

Strait of Juan de Fuca Baitfish Resources



Source: Washington Department of Fisheries
 This map does not offer complete information on fish and shellfish resources.
 Comprehensive inventories have not been completed along all shorelines.

DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Surf Smelt (*Hypomesus pretiosus*)

Resource Information Mapped: Intertidal surf smelt spawning areas.

Resource Use: Human; commercial and recreational harvest. Non-human; smelt are an important component of the marine food chain; they provide the link between primary production and upper level predators. All life history stages are utilized as food by various predators including salmon, rockfish, lingcod, halibut, birds, marine mammals, etc.

General Location of Sensitive Resource: Surf smelt deposit their eggs in the uppermost intertidal zone on gravel generally having a grain size from 1 to 7 mm. Incubation takes 2 - 4 weeks. Larvae are found in adjacent nearshore surface waters for several weeks following hatching. Spawning areas exist in Sequim Bay, Dungeness Bay, and along the Strait between the Lyre River and Twin Rivers. Other undocumented spawning areas are suspected along the Strait.

Seasonal Sensitivity or Occurrence: Surf smelt spawning along the outer Olympic Peninsula and Strait of Juan de Fuca occurs from mid-May through the end of September. Spawning occurs in Dungeness Bay from mid-October through mid January. Eggs and larvae are highly susceptible to injury (lethal) from oil exposure.

Recommended Protection Strategy: Keep oil off of spawning beaches regardless of season. In particular keep oil out of Sequim Bay and Dungeness Bay to protect incubating eggs and planktonic larvae.

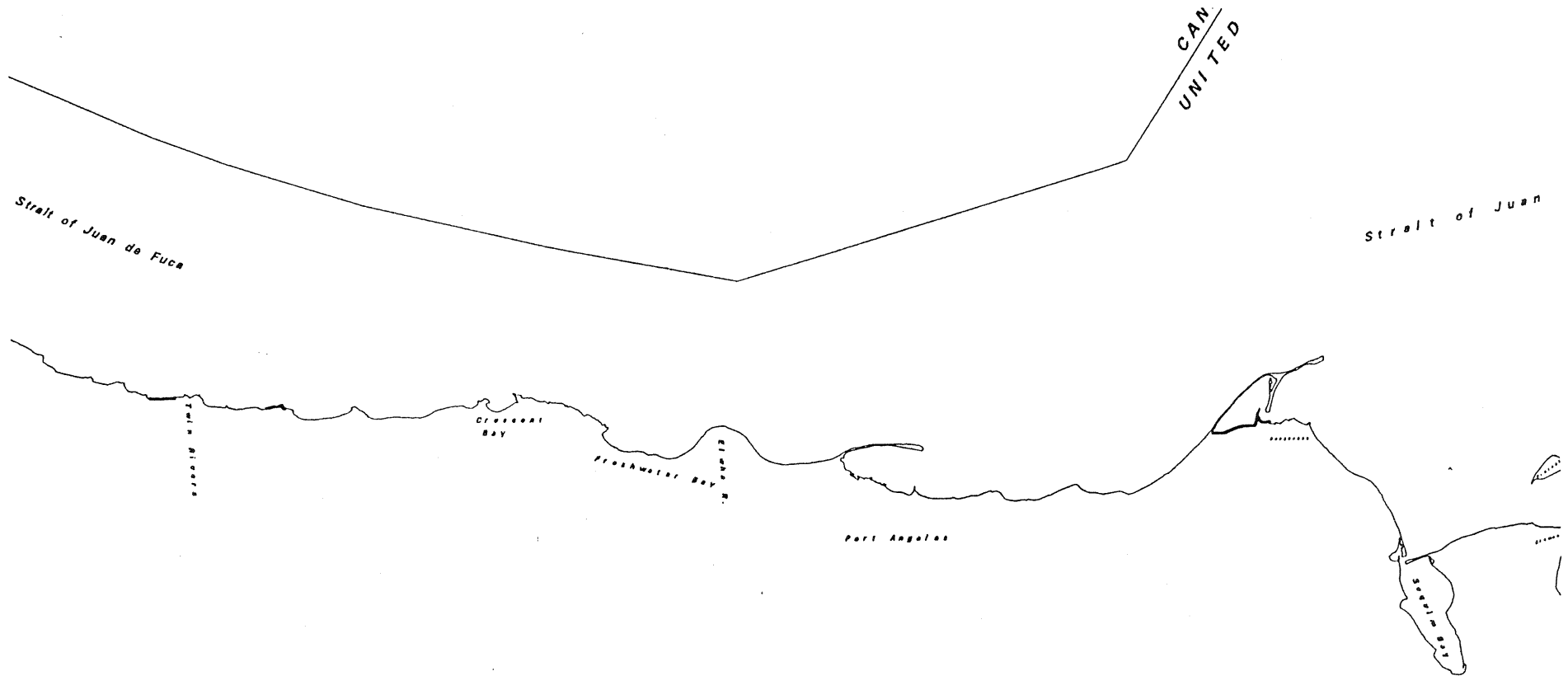
Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

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- Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.
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Strait of Juan de Fuca Baitfish Resources

STRAIT OF JUAN DE FUCA GRP



March 15, 1996

6-29

Smelt Spawning

USGS Shoreline

Source: Washington Department of Fisheries

This map does not offer complete information on fish and shellfish resources. Comprehensive inventories have not been completed along all shorelines.

DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Pacific Sand Lance (*Ammodytes hexapterus*)

Resource Information Mapped: Documented intertidal spawning areas and larval rearing areas.

Resource Use: Human; sand lance are used as bait by recreation fishers. Non-human; sand lance are an important component of the marine food chain; they provide the link between primary production and upper level predators. All life history stages are utilized as food by various predators including salmon, rockfish, lingcod, halibut, birds, marine mammals, etc.

General Location or Habitat Association of Resource: Pacific sand lance spawn from November through February and deposit their eggs on upper intertidal sandy-gravel beaches. Documented spawning areas in the region include Sequim Bay, Dungeness Bay, and several sites within Port Townsend Bay. Sand lance larvae are widespread in the regions near-surface waters from January through March. Documented areas include Discovery Bay, Sequim Bay, Dungeness Bay, and the Straits between Port Angeles and Dungeness. It is suspected that additional spawning and larval habitat exists along the western Straits. Adult sand lance are found in nearshore habitats throughout the Strait of Juan de Fuca.

Seasonal Sensitivity: The highest sensitivity is during the spawning and larval stages from mid-October through March. Eggs and larvae are highly susceptible to injury (lethal) from oil exposure.

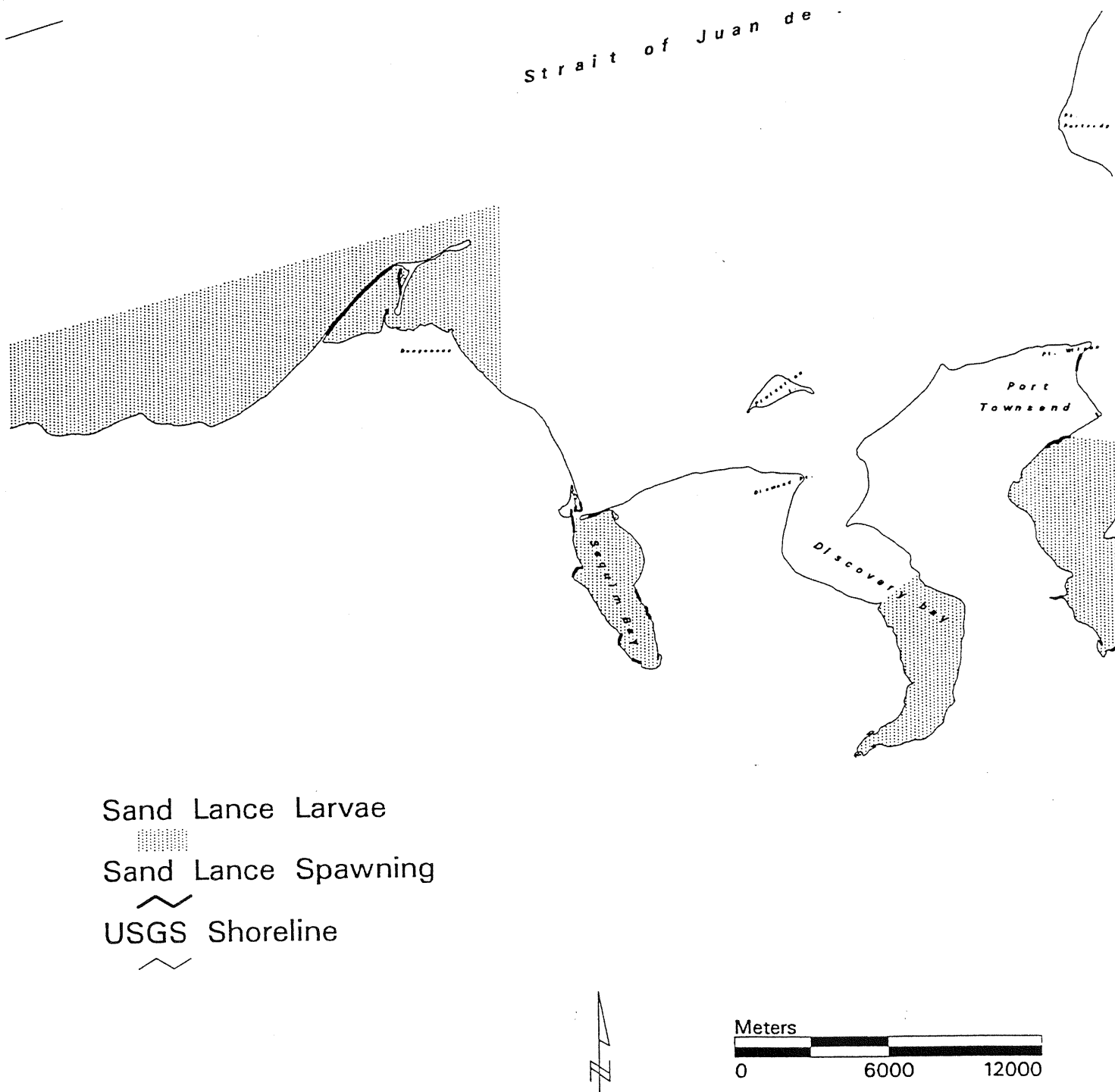
Recommended Protection Strategy: Keep oil off of spawning beaches regardless of season. In particular keep oil out of Sequim Bay, Discovery Bay, and Dungeness Bay to protect incubating eggs and planktonic larvae.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

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Strait of Juan de Fuca Baitfish Resources



Source: Washington Department of Fisheries

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DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Pacific Salmon

Resource Information Mapped: Anadromous streams and rivers utilized by one or more of the following species for spawning and rearing: chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*), chum (*O. keta*), and pink (*O. gorbuscha*).

Resource Use: Human; extensive commercial and recreational fisheries. Non-human; the list of predators on the various life history stages of salmon is extensive and includes several species of birds (bald eagle), fish, marine mammals, and terrestrial mammals.

General Location or Habitat Association of Resource: Salmon spawn and rear in all major Washington watersheds and in many of the smaller tributaries. Salmon are anadromous in that they begin life in fresh water, spend the largest portion of their life in salt water, then return to fresh water to spawn. There is a broad range of life history types both between and within the species. Both juvenile and adult salmon are present year round throughout this region.

Seasonal Sensitivity: Varies with species, stock, and river system. See habitat association and timing table.

Recommended Protection Strategy: In the river deltas contain and recover oil in the main channels. Keep oil off of the intertidal flats. Where oil cannot be excluded from the intertidal flats use clean up techniques which do not force oil into beach substratum or transport it into the lower intertidal or subtidal zones. Employ exclusion, deflection or diversion boom at river and stream mouths which are tidally influenced.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

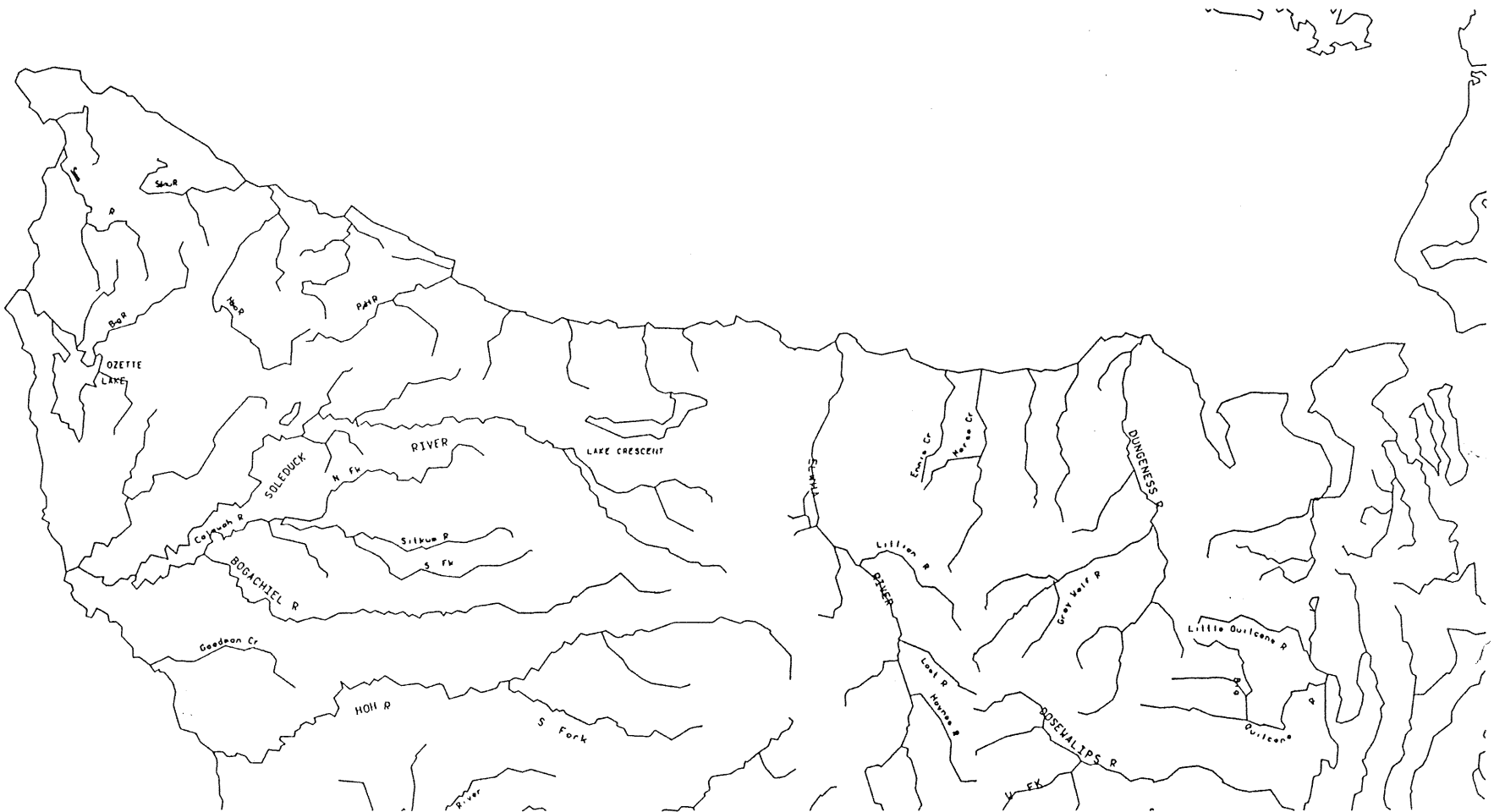
References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

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Strait of Juan de Fuca Fish Resources

STRAIT OF JUAN DE FUCA GRP



March 15, 1996

6-33

Anadromous Rivers

Source: Washington Department of Fisheries

This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed along all shorelines.

DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Rockfish (Sebastes spp.)

Resource Information Mapped: Critical juvenile (young-of-the-year) rockfish habitat.

Resource Use: Human; rockfish are an important commercial and recreational species complex. Non-human; rockfish are utilized as food organisms by various marine fish species including lingcod and by marine mammals.

General Location or Habitat Association of Resource: High densities of juvenile rockfish are found in nearshore kelp beds. Fish are often found within 50 cm of the surface. This habitat is critical to their survival, it provides protective cover as well as food. While all the kelp beds along the Straits provide juvenile habitat, beds of particular interest include those from Cape Flattery to Neah Bay (Waadah Island) and Pillar Point east to Jim Creek.

Seasonal Sensitivity: High densities of juvenile rockfish are found in the kelp beds from June through September.

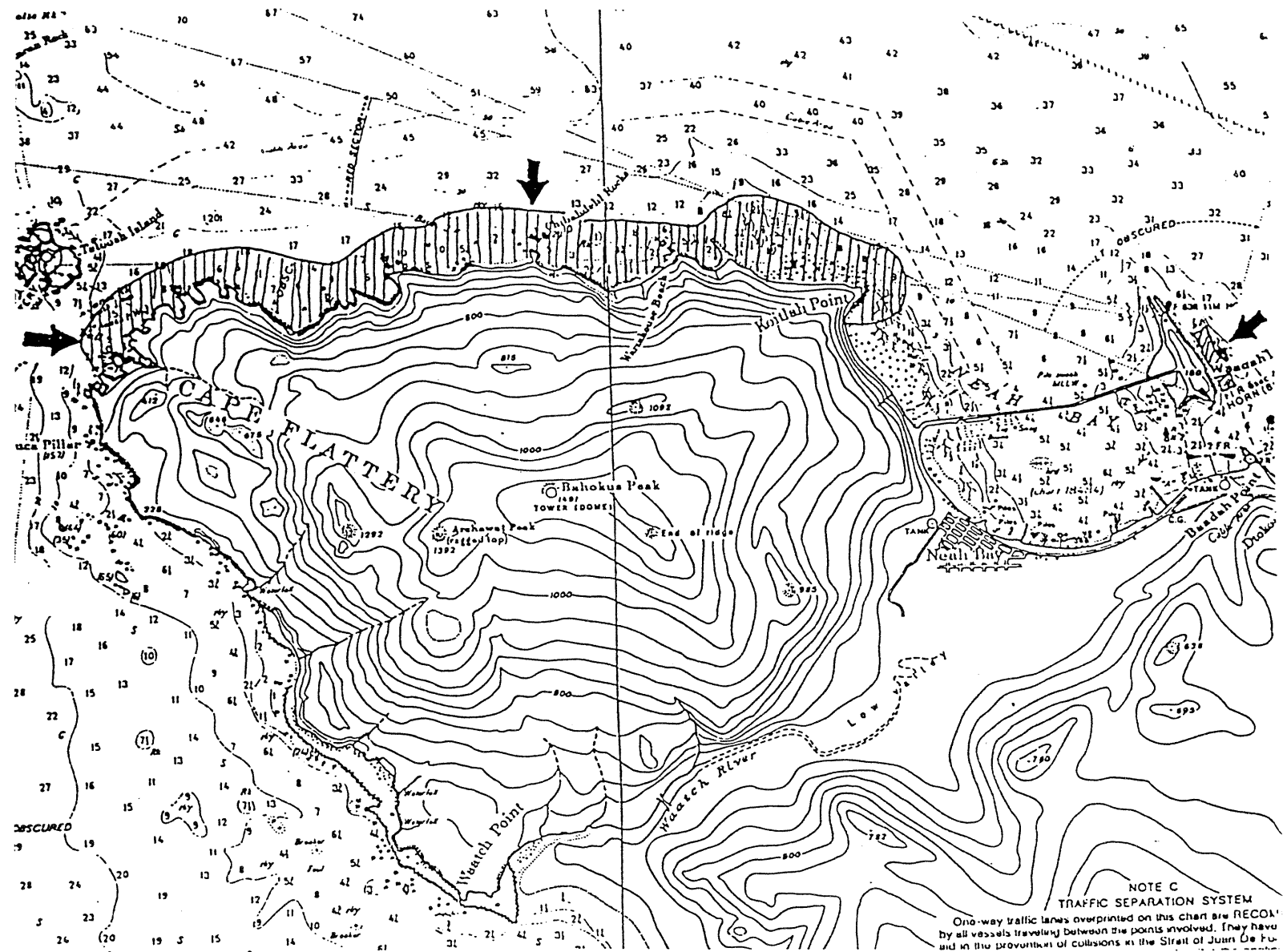
Recommended Protection Strategy: Utilize exclusion, deflection or diversion boom to prevent oil from entering or penetrating into critical kelp beds. The beds mentioned above are a high priority for protection.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit and Marine Habitat Investigations Unit

References:

- Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.
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Strait of Juan de Fuca Fish Resources



Juvenile Rockfish Rearing

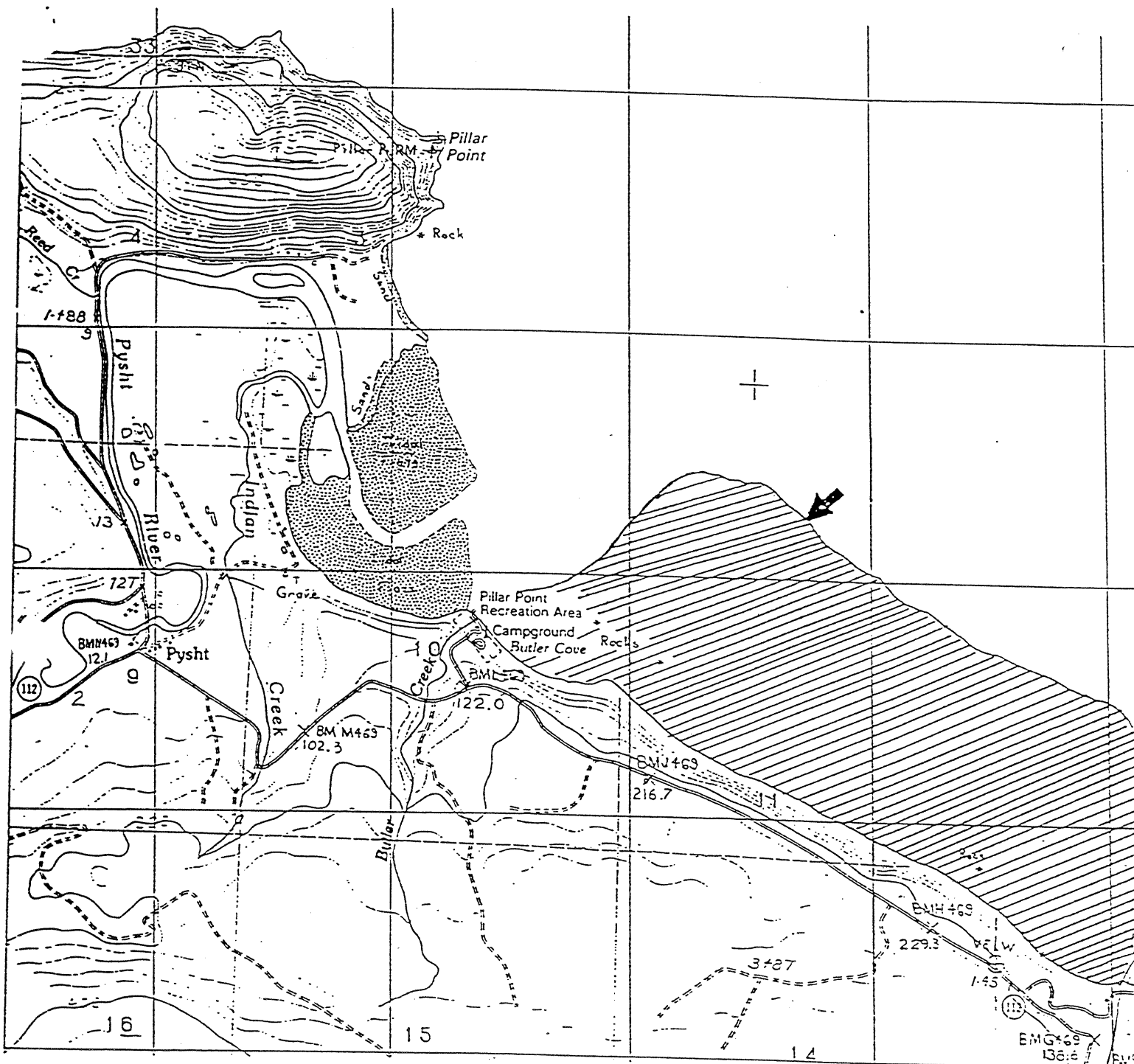


Source: Washington Department of Fisheries

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Strait of Juan de Fuca Fish Resources



Juvenile Rockfish Rearing



Source: Washington Department of Fisheries

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**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Lingcod (*Ophiodon elongatus*)

Resource Information Mapped: Critical juvenile (young-of-the-year) rearing habitat.

Resource Use: Human; lingcod are an important commercial and recreation species. Non-human; larvae and juvenile fish are eaten by other fish species, eggs are eaten by crabs, starfish, sea urchins, and fish.

General Location or Habitat Association of Resource: The area at the mouth of the Pysht River near Pillar Point has been documented as an important nursery area for juvenile lingcod. They prefer the eelgrass/sand bottom habitat. Juvenile Pacific cod also utilize this area as a nursery ground.

Seasonal Sensitivity: June through September.

Recommended Protection Strategy: Employ exclusion, deflection or diversion booming to prevent contamination of the eelgrass beds. Utilization of shoreline clean up techniques which do not transport oil into the subtidal.

Information Source: WDF - Oil Spill Response and Damage Prevention Unit and Marine Habitat Investigations Unit

References:

- Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.
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Strait of Juan de Fuca Fish Resources



Juvenile Lingcod Rearing



Source: Washington Department of Fisheries

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DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Cancer Crab

Resource Information Mapped: Dungeness (*Cancer magister*) and red rock (*C. productus*) crab distribution. Map depicts primarily adults but does cover some juvenile areas. Important juvenile habitat will correlate with the herring spawning (eelgrass) and oyster areas (see appropriate maps).

Resource Use: Human; large commercial and recreational harvest. Non-human; all life history phases are utilized as food by numerous fish species (eg. Pacific herring, lingcod, rockfish, coho and chinook salmon, halibut, English sole and cabezon), octopus, sea otters, harbor seals, sea lions, and gulls.

General Location or Habitat Association of Resource: Adults are found from the intertidal to -90 m MLLW and prefer sandy substrates. Juveniles are found intertidally and typically associated with eelgrass, ulva, bivalve shells, or some form of cover, from +3 to -15 m MLLW. Larvae and megalopae are planktonic. Megalopae are typically found in nearshore waters where they settle to the bottom and metamorphose into juveniles during summer. Females carry incubating eggs beginning in the fall and hatching occurs between February and April.

Seasonal Sensitivity: Larvae/megalopae - planktonic - March through July. Juveniles - epibenthic intertidal - year-round.

Recommended Protection Strategy: Protect nearshore juvenile habitat, particularly eelgrass beds. Important locations include Discovery Bay, Dungeness Bay, western Freshwater Bay, Crescent Bay, Agate Bay and the mouth of the Lyre River.

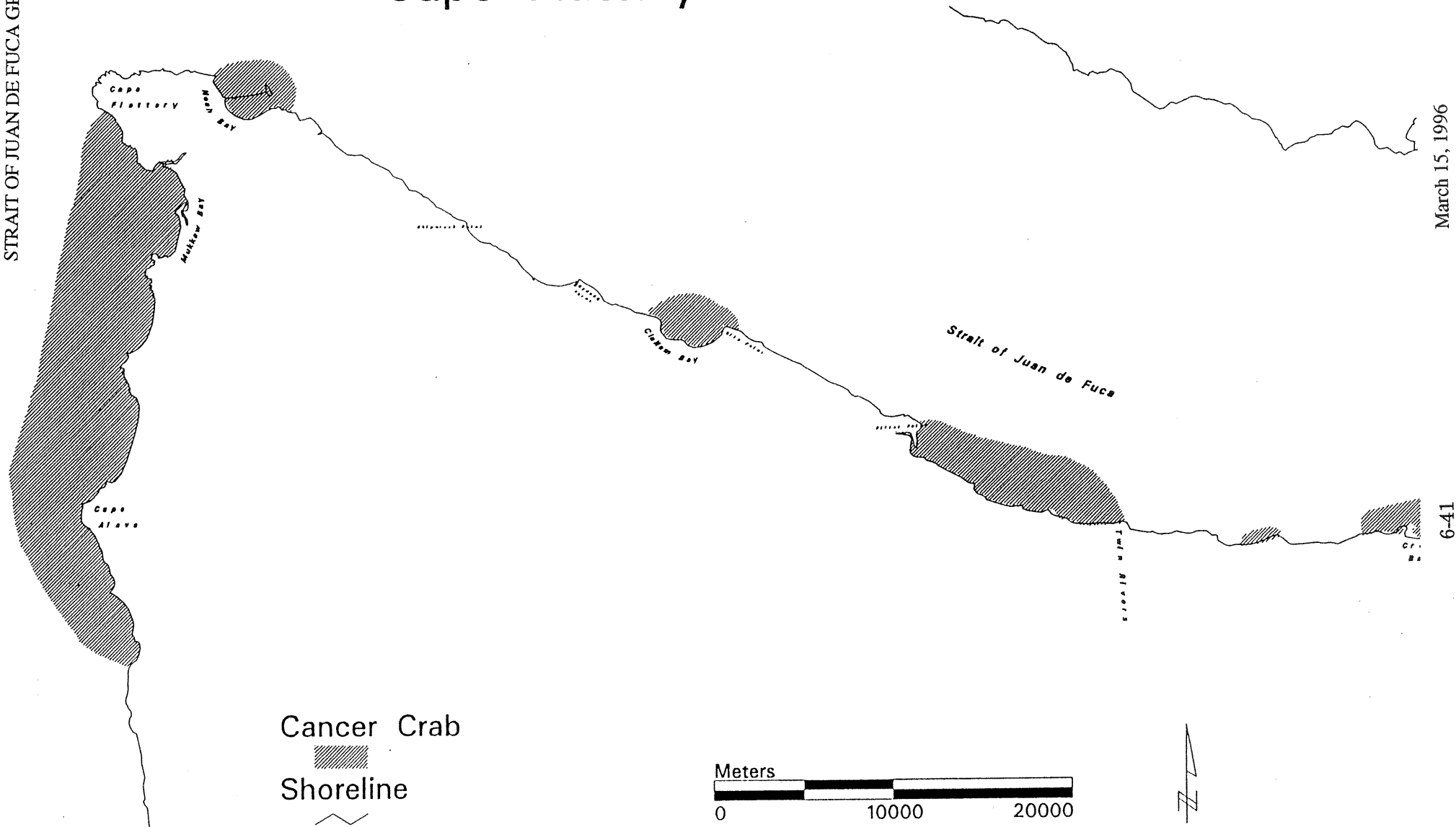
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- Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

Strait of Juan de Fuca Shellfish Resources Cape Flattery to Low Point

STRAIT OF JUAN DE FUCA GRP



March 15, 1996

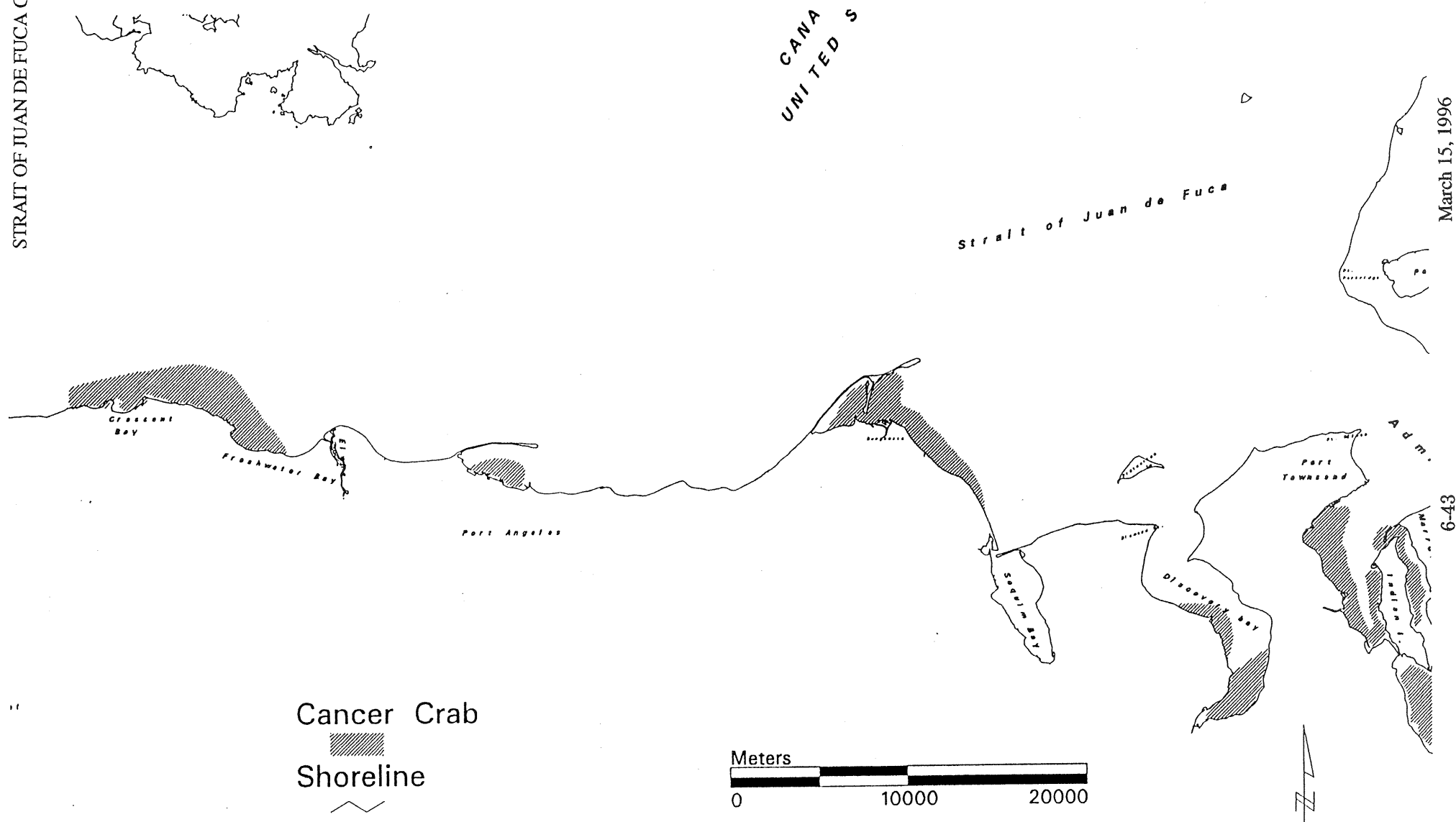
6-41

Source: Washington Department of Fisheries

This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed along all shorelines.

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Strait of Juan de Fuca Shellfish Resources Low Point to Port Townsend



Source: Washington Department of Fisheries
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DRAFT - May 18, 1993

Strait of Juan de Fuca Geographic Response Plan Workshop Data Recording Sheet

Resource: Intertidal and subtidal hardshell clams, and intertidal softshell clams.

Resource Information Mapped: Hardshell intertidal include the native littleneck (*Protothaca staminea*), the Manila littleneck (*Tapes philippinarum*), butter clams (*Saxidomus giganteus*), piddock clams (*Zirfaea pilsbryi*), and horse clams (*Tresus capax* and *T. nuttallii*), and cockles (*Clinocardium nuttali*). Subtidal includes butter clams, piddock clams and horse clams. Softshell intertidal includes only the eastern softshell clam (*Mya arenaria*).

Resource Use: Human; commercial and recreational harvest. Non human; as a group clams are feed upon by a wide variety of organisms including snails, sea stars, Dungeness and rock crabs, several species of commercially and recreationally import fish, sea otters, raccoons, scoters and other birds.

General Location or Habitat Association of Resource: Clams are found throughout the region with higher concentrations in Dungeness Bay, Sequim Bay, and Discovery Bay. Clams are found from approximately +2 m MLLW in the intertidal zone to subtidal depths of -21 m MLLW.

Seasonal Sensitivity: Due to their sessile lifestyle in the intertidal zone clams are at high risk of exposure throughout the year. Sensitivity would be elevated during the spawning and larval period which can extend from April through October.

Recommended Protection Strategy: Keep oil out of Dungeness Bay, Sequim Bay, and Discovery Bay. Where oil cannot be excluded from the beach use clean up techniques which do not force oil into beach substratum.

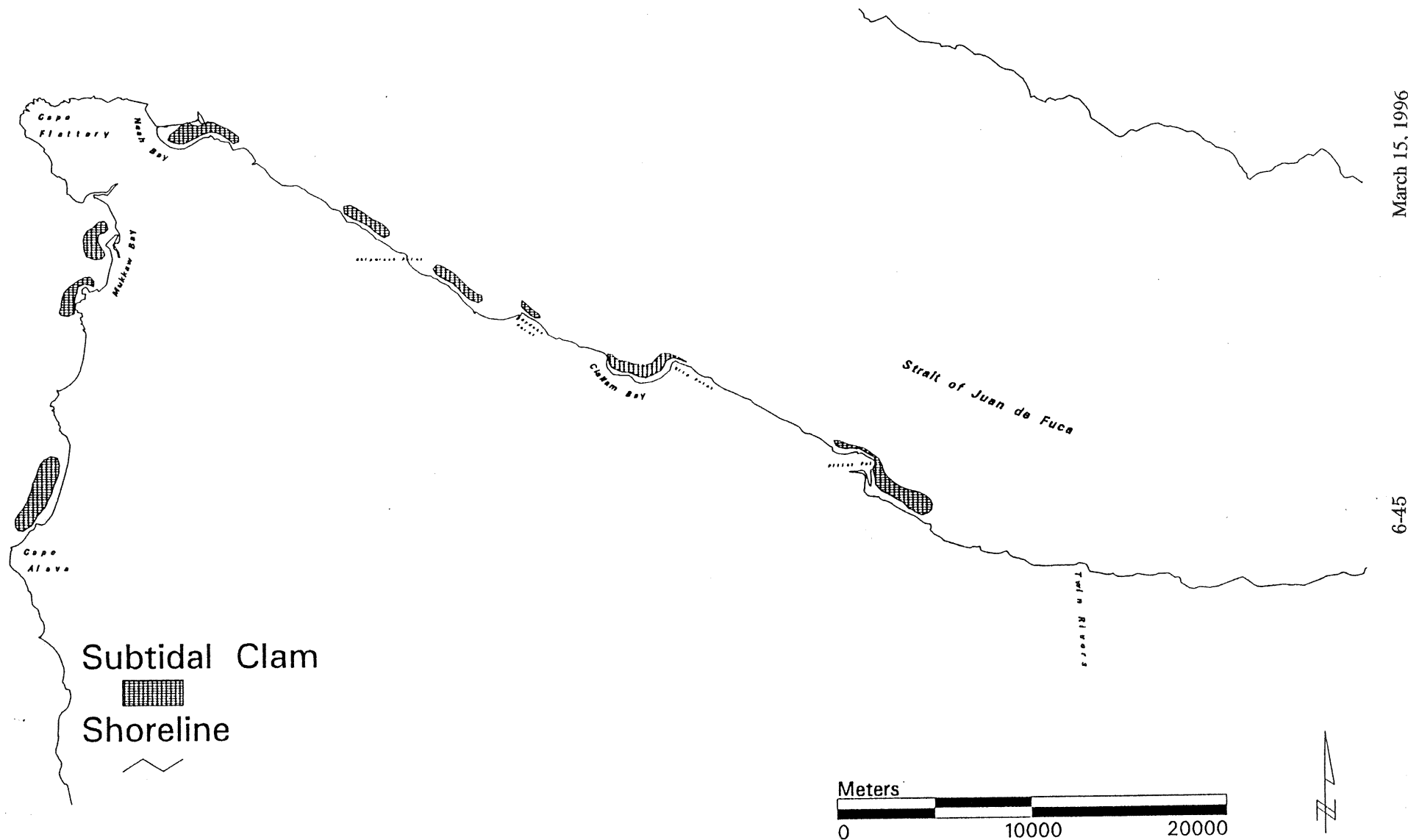
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Strait of Juan de Fuca Shellfish Resources Cape Flattery to Low Point



March 15, 1996

6-45

Source: Washington Department of Fisheries

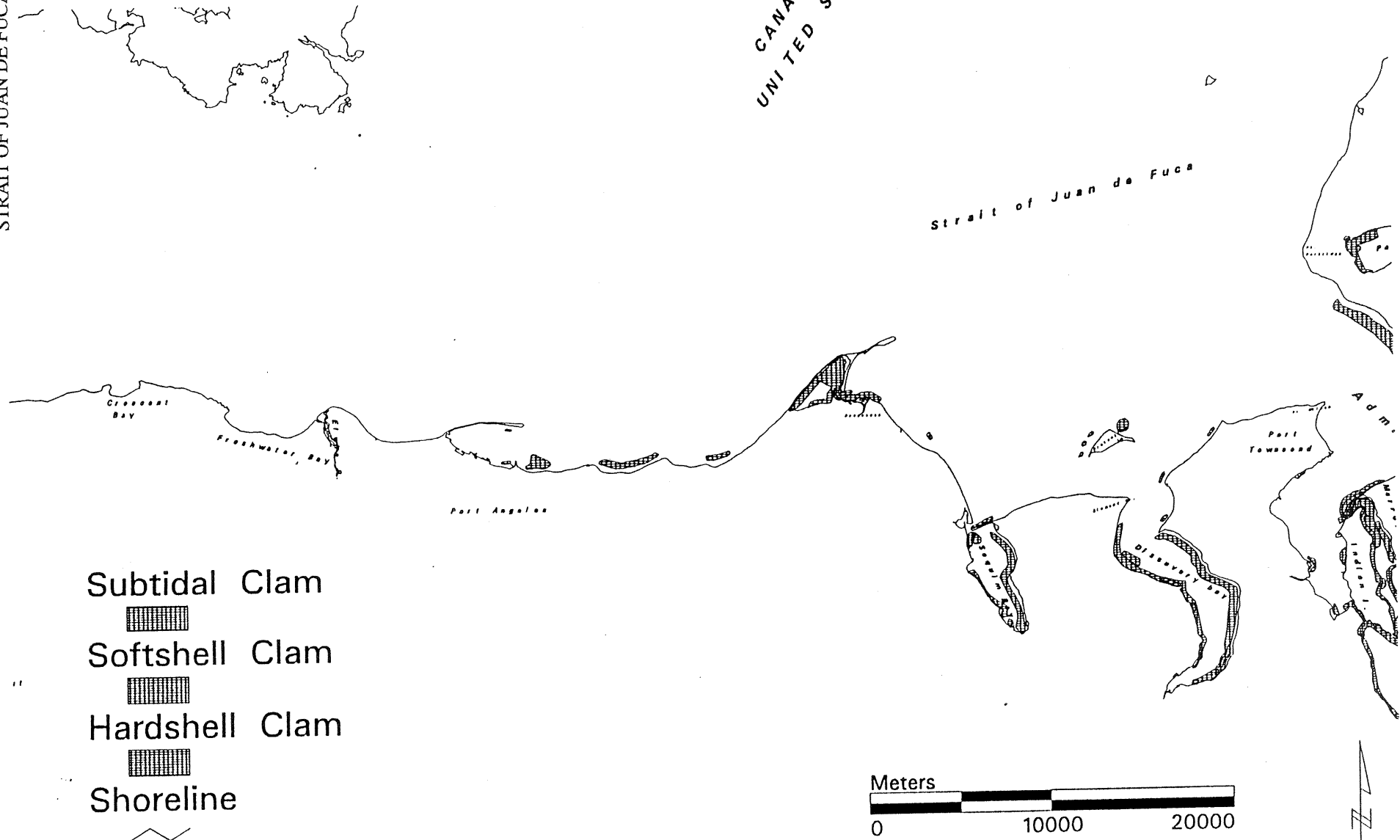
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Strait of Juan de Fuca Shellfish Resources Low Point to Port Townsend

STRAIT OF JUAN DE FUCA GRP

CANADA
UNITED STATES



March 15, 1996

6-47

Source: Washington Department of Fisheries
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DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Geoduck Clams (*Panope abrupta*)

Resource Information Mapped: Distribution of commercially harvestable quantities of geoduck clams.

Resource Use: Human; Geoducks support a large commercial and recreational fisheries. Non human; Geoducks are fed upon by snails, pandalid shrimp, rock crab, English sole, sand sole, rock sole, starry flounder, starfish, and sea otters.

General Location or Habitat Association of Resource: Geoducks are found throughout the region and inhabit depths from +1 to -110 m MLLW. Preferred substrate is stable mud and sand.

Seasonal Sensitivity: Sensitivity would be highest during the spawning and larval period from April through August (peak May - July).

Recommended Protection Strategy: Utilize beach clean up techniques which do not transport oil into the subtidal zone.

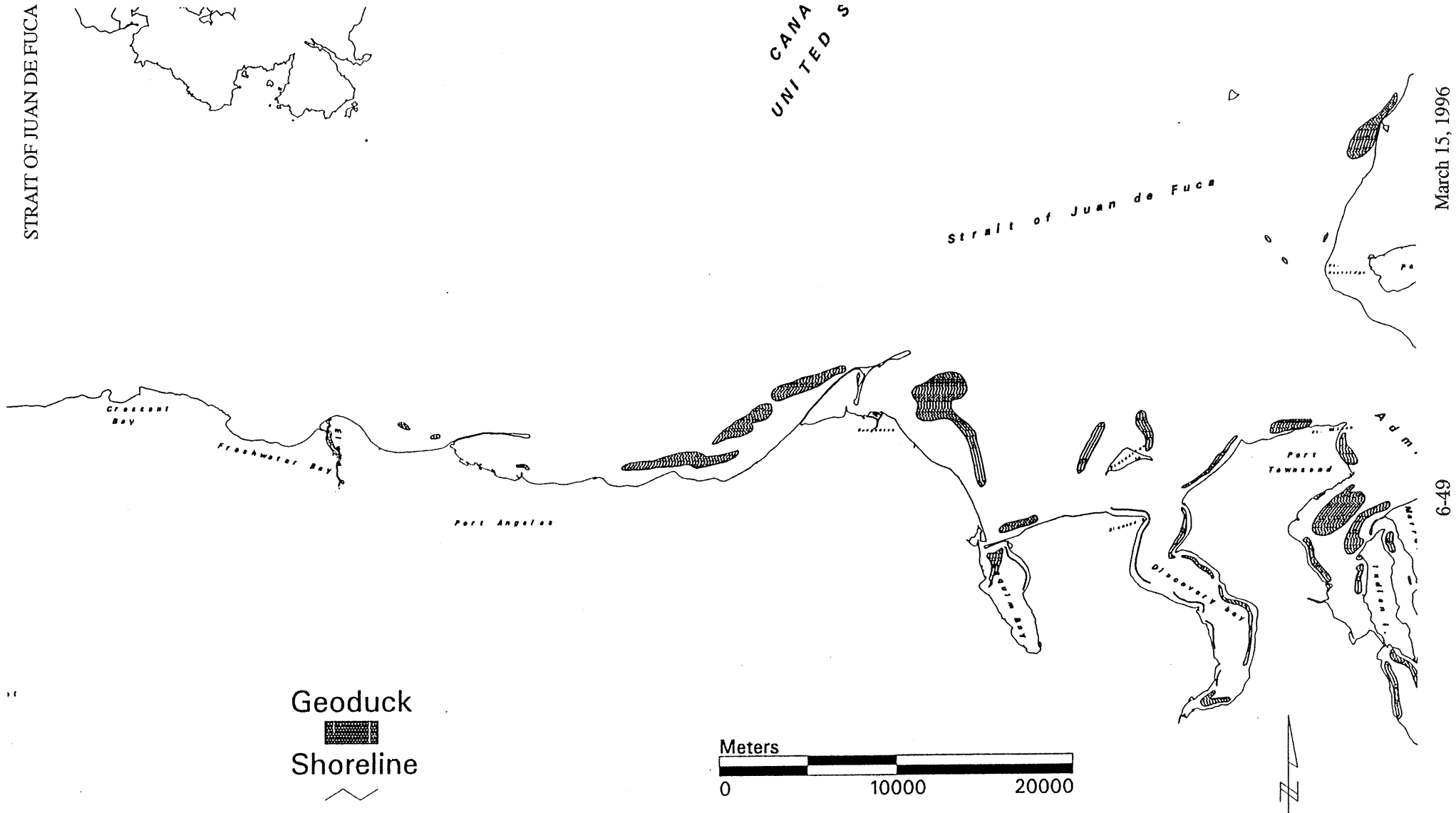
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Strait of Juan de Fuca Shellfish Resources Low Point to Port Townsend

STRAIT OF JUAN DE FUCA GRP



March 15, 1996

6-49

Source: Washington Department of Fisheries
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DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Pacific Oyster (*Crassostrea gigas*)

Resource Information Mapped: Oyster beds, primarily cultured.

Resource Use: Human; recreational and commercial harvest. Non-human; oyster beds provide important habitat for juvenile dungeness crab. Juvenile and adult oysters are preyed upon by dungeness and red rock crab, several starfish species, and surf and white-winged scoters.

General Location or Habitat Association of Resource: Pacific oysters are found in the lower intertidal and shallow subtidal zones in Dungeness Bay and Sequim Bay.

Seasonal Sensitivity: Due to their sessile lifestyle in the intertidal zone oysters are at high risk of exposure throughout the year. Relative to their habitat function for juvenile dungeness crab the most sensitive period would be June through December.

Recommended Protection Strategy: Use exclusion, deflection or diversion boom to keep oil out of Dungeness Bay and Sequim Bay.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

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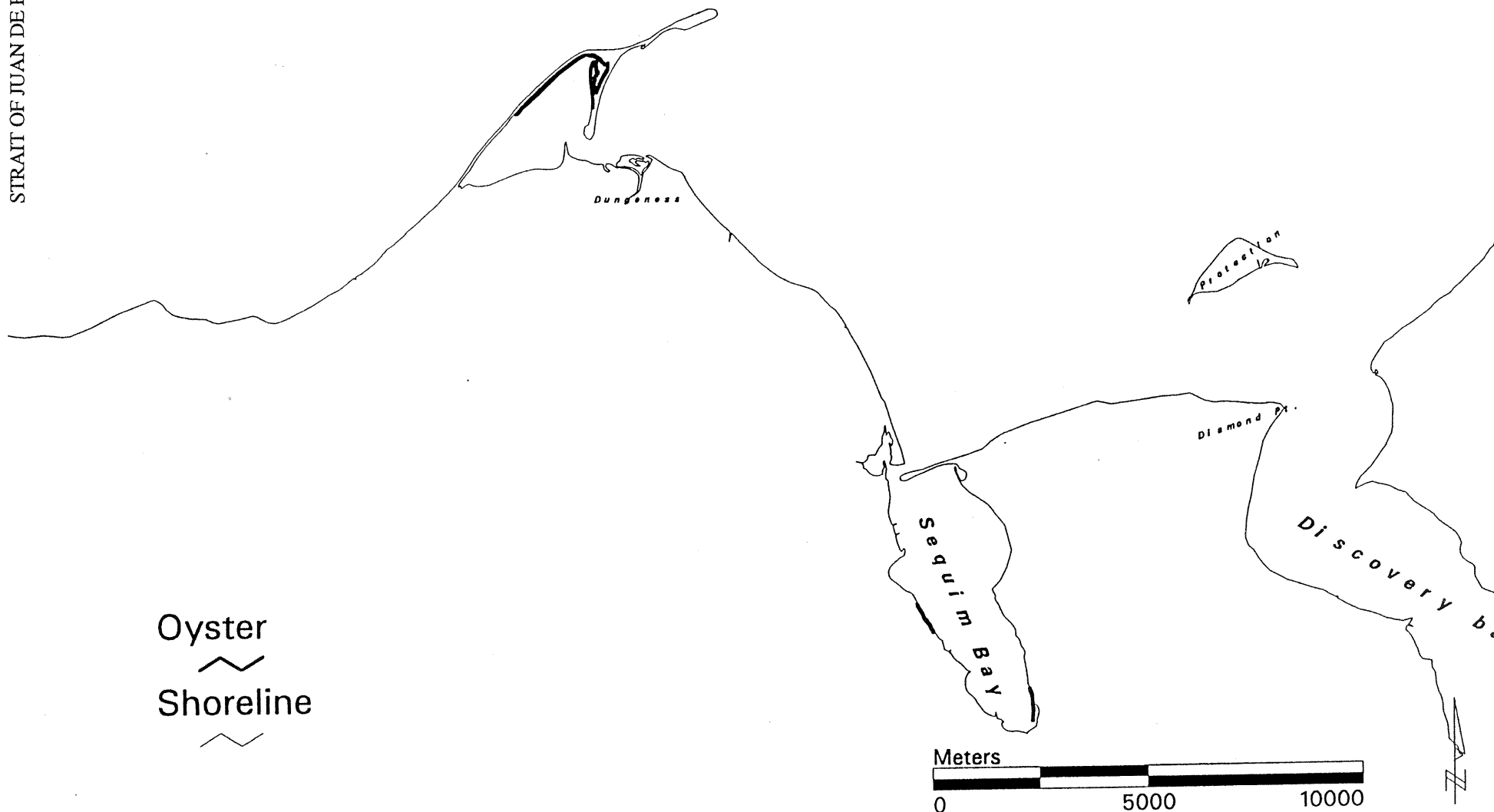
Strait of Juan de Fuca Shellfish Resources Low Point to Port Townsend

STRAIT OF JUAN DE FUCA GRP

March 15, 1996

6-51

Oyster
Shoreline



Source: Washington Department of Fisheries
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DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
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Resource: Sea Urchin

Resource Information Mapped: Commercially harvestable quantities of adult sea urchins, primarily the red sea urchin (*Strongylocentrotus franciscanus*).

Resource Use: Human - commercial fishery. Non-human - dominant organism in rocky nearshore communities, responsible for shaping the character of the habitat through their grazing activities. Important prey item for wolf eels and sea otters.

General Location or Habitat Association of Resource: Sea urchins populate the kelp beds along the entire length of the Strait of Juan de Fuca. Urchins are found from the lower intertidal to depths of 125 m but the highest densities are found at depths less than 30 m. Juveniles are found in adult habitat and require the adults presence to survive.

Seasonal Sensitivity: Spawning occurs during the spring followed by a planktonic larval phase that lasts from 60 to 130 days. Adults are susceptible to oil exposure via ingestion of contaminated marine algae, particularly kelp. Highest risk of this type of exposure is from April to November.

Recommended Protection Strategy: Prevent oil from contaminating nearshore kelp beds. Utilize exclusion or diversionary booms in critical areas. Employ beach clean up techniques that do not transport oil into shallow subtidal area.

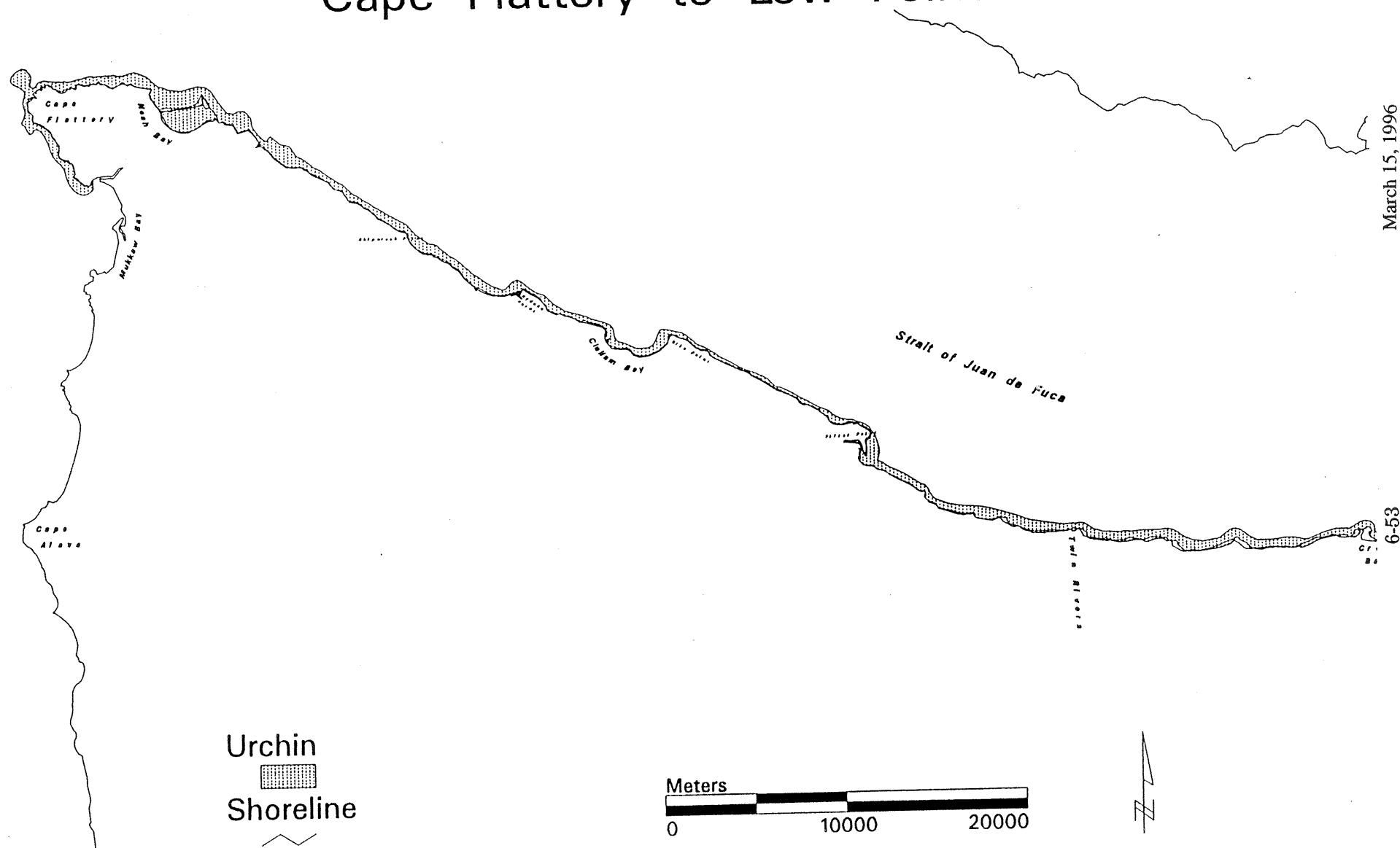
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Strait of Juan de Fuca Shellfish Resources

Cape Flattery to Low Point

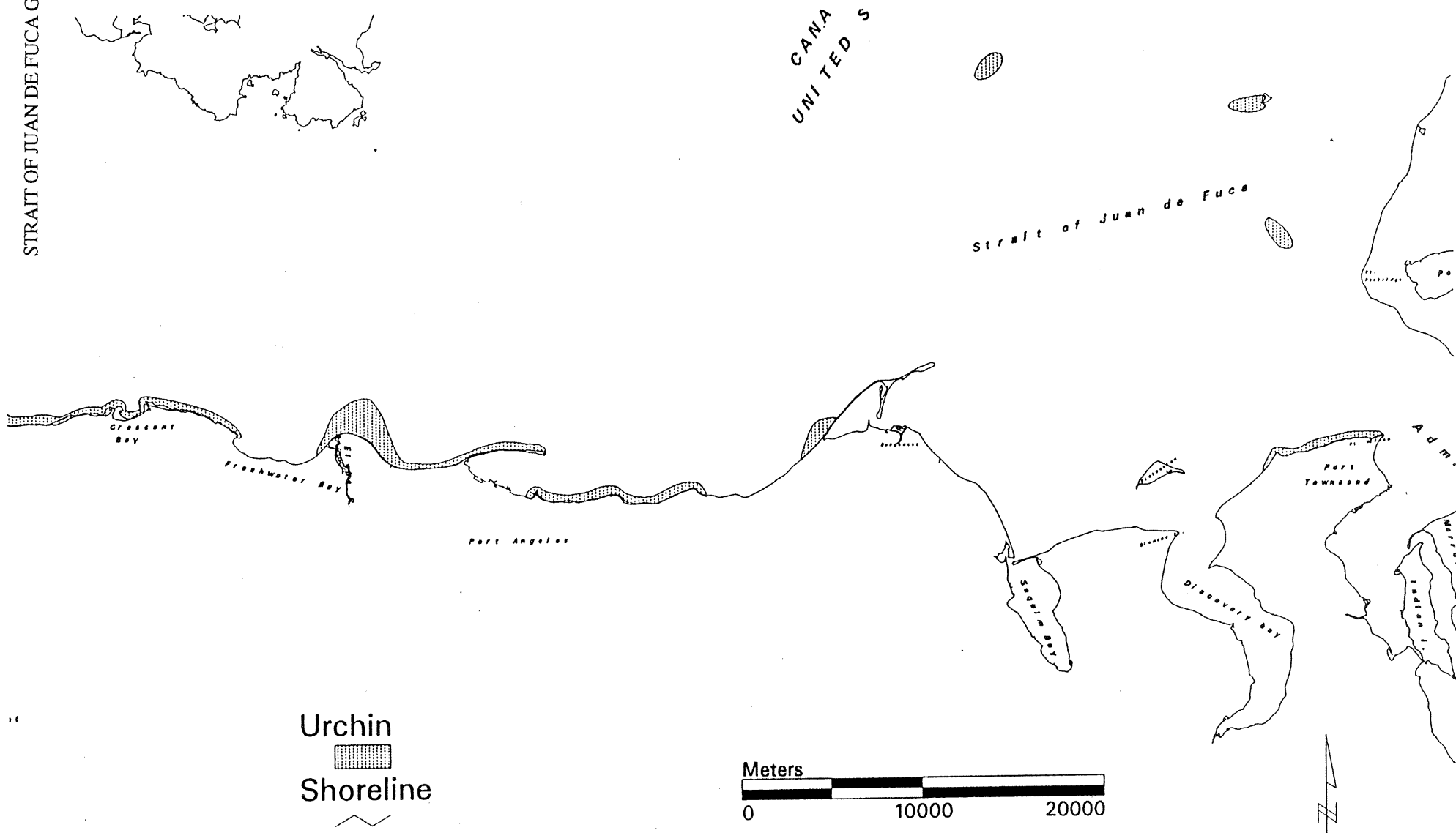


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Strait of Juan de Fuca Shellfish Resources Low Point to Port Townsend

STRAIT OF JUAN DE FUCA GRP



March 15, 1996

6-55

Source: Washington Department of Fisheries
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DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Northern Abalone (*Haliotis kamtschatkana*)

Resource Information Mapped: Documented areas of abalone presence.

Resource Use: Human; recreational fishery only. Non-human; important prey item for sea otters, octopus, and cabezon.

General Location or Habitat Association of Resource: Abalone are found along exposed or semi-exposed bedrock or boulder shorelines from the intertidal zone to depths of 20 m.

Seasonal Sensitivity: Adult abalone congregate in the shallow subtidal zone to spawn from April through June. Abalone broadcast eggs and sperm into the water column and fertilized eggs sink to the bottom and hatch within days. Larvae spend 5 to 6 days as free swimmers in the water column. Adults are susceptible to oil exposure via ingestion of contaminated marine algae, particularly kelp. Highest risk of this type of exposure is from April to November.

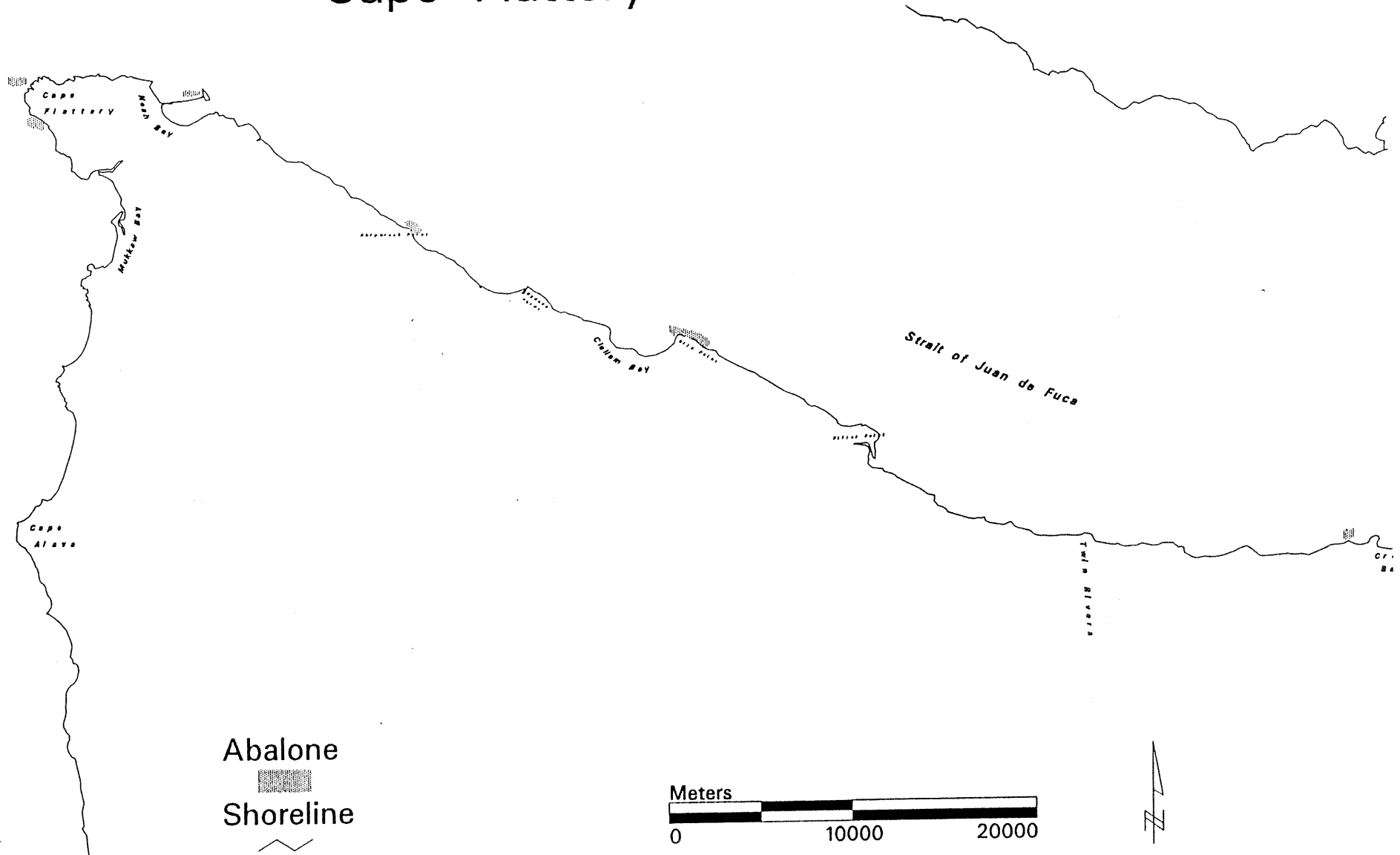
Recommended Protection Strategy: Prevent oil from contaminating nearshore kelp beds. Utilize exclusion or diversionary booms in critical areas. Employ beach clean up techniques that do not transport oil into shallow subtidal area.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

Strait of Juan de Fuca Shellfish Resources Cape Flattery to Low Point



March 15, 1996

6-57

Source: Washington Department of Fisheries
 This map does not offer complete information on fish and shellfish resource distribution.
 Comprehensive inventories have not been completed along all shorelines.

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Strait of Juan de Fuca Shellfish Resources Low Point to Port Townsend

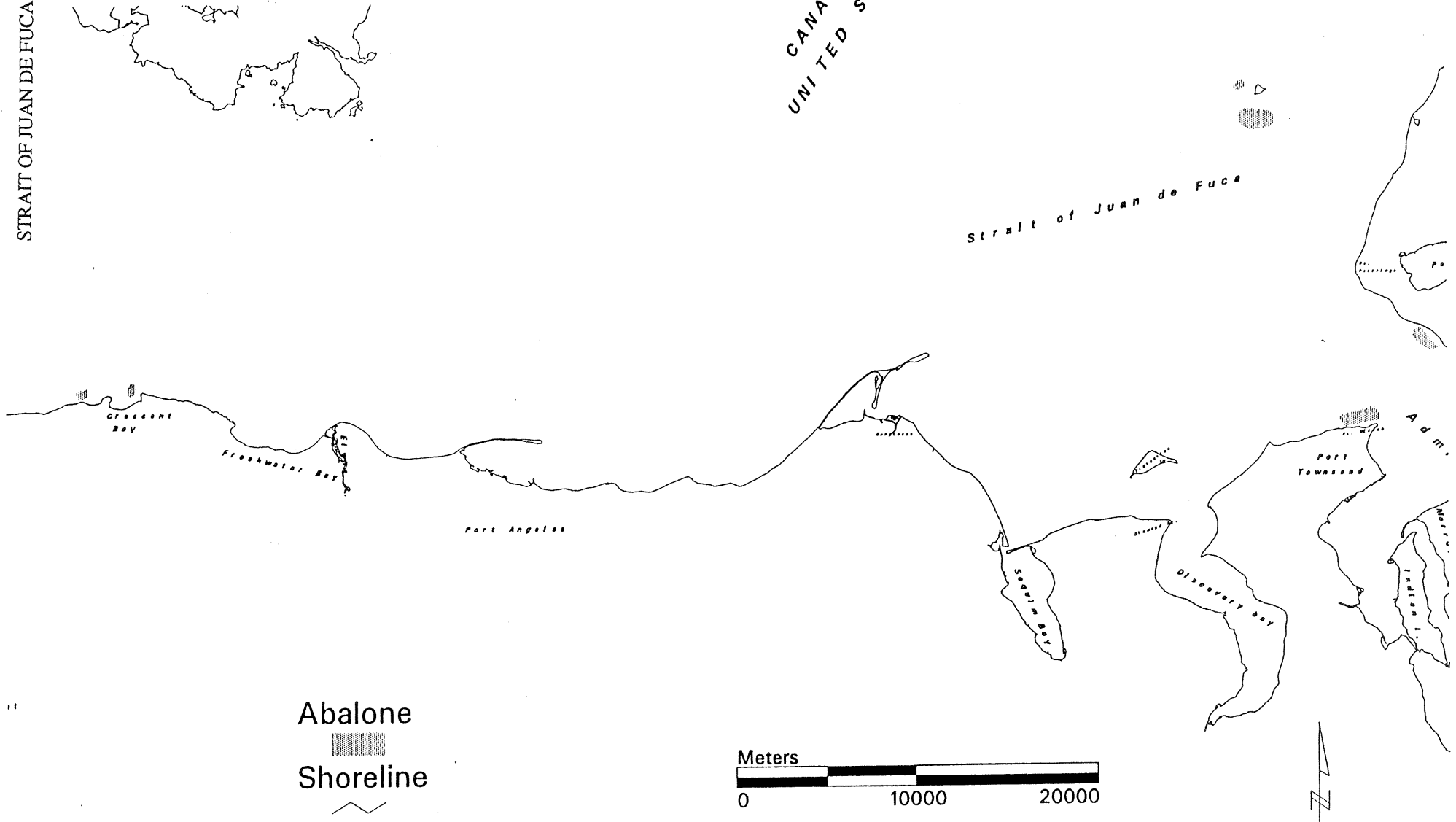
STRAIT OF JUAN DE FUCA GRP

CANADA
UNITED STATES

Strait of Juan de Fuca

March 15, 1996

6-59



Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution.
Comprehensive inventories have not been completed along all shorelines.

DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Octopus (*Octopus dofleini*)

Resource Information Mapped: Documented octopus habitat.

Resource Use: Harvested in commercial, recreational, and subsistence fisheries.

General Location or Habitat Association of Resource: Octopus live in caves or dens from the lower intertidal to the subtidal zones.

Seasonal Sensitivity: The portion of the population inhabiting the lower intertidal and shallow subtidal zone would be subject to exposure during extreme low tides throughout the year. Octopus are also susceptible to exposure via contaminated prey, particularly clams and crab.

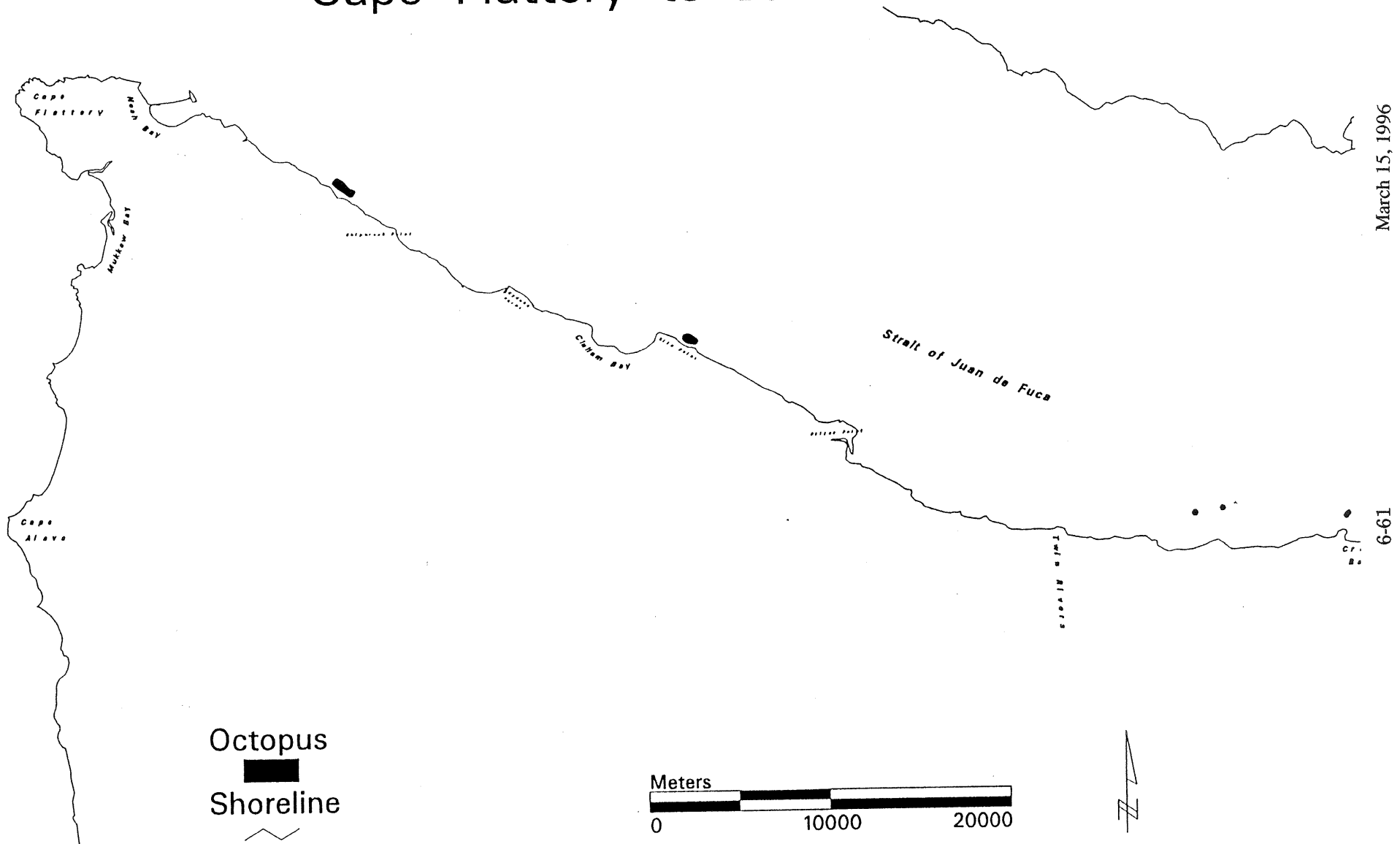
Recommended Protection Strategy: Utilize beach clean up techniques that do not transport oil into shallow subtidal area.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

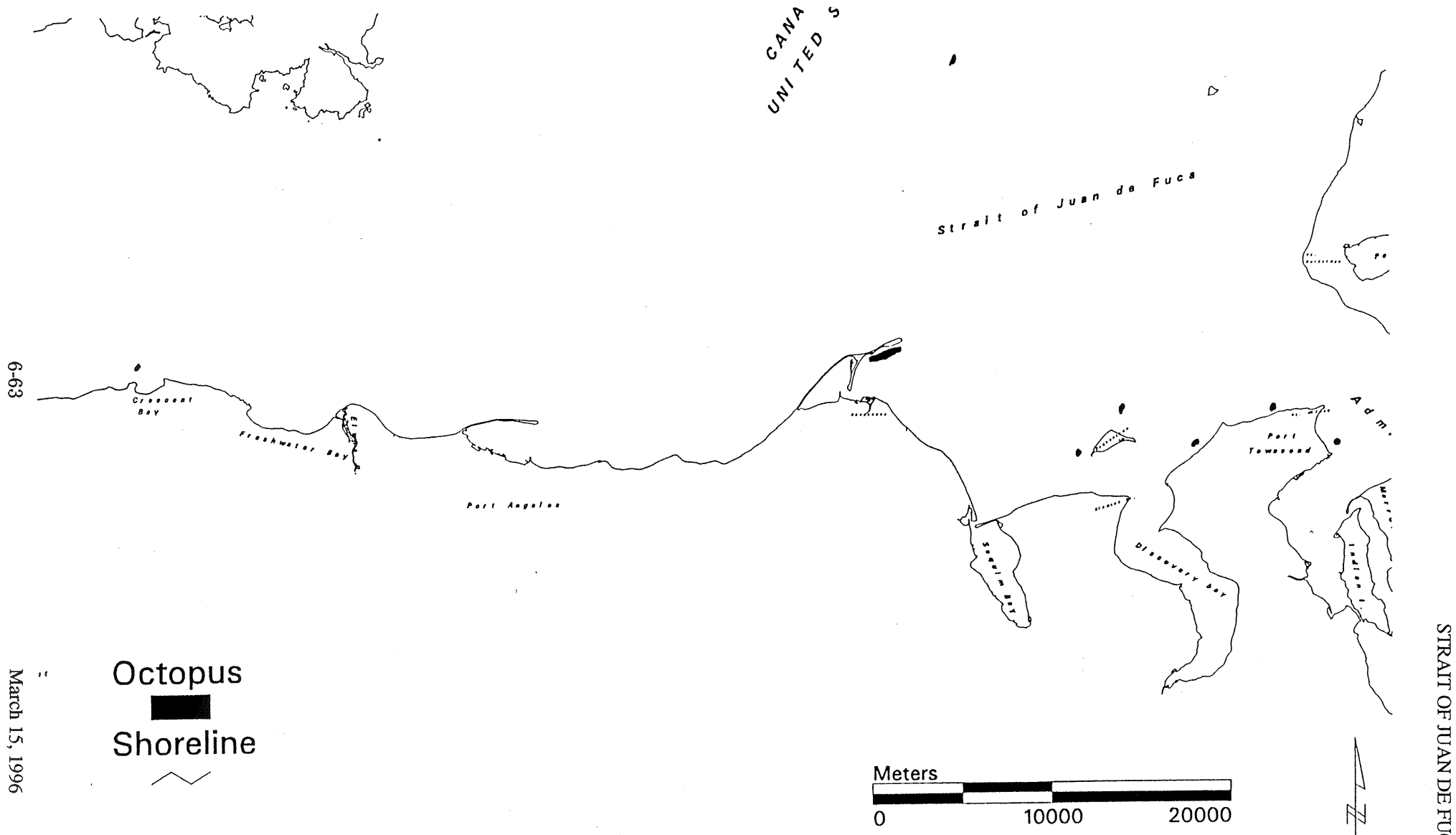
Strait of Juan de Fuca Shellfish Resources Cape Flattery to Low Point



Source: Washington Department of Fisheries
 This map does not offer complete information on fish and shellfish resource distribution.
 Comprehensive inventories have not been completed along all shorelines.

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Strait of Juan de Fuca Shellfish Resources Low Point to Port Townsend



Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution.
Comprehensive inventories have not been completed along all shorelines.

DRAFT - May 18, 1993

**Strait of Juan de Fuca Geographic Response Plan Workshop
Data Recording Sheet**

Resource: Pandalid Shrimp

Resource Information Mapped: Harvest areas for four species of shrimp including; pink (*Pandalus jordani* and *P. borealis*), coonstripe (*P. danae*), and spot prawn (*P. platyceros*).

Resource Use: Human; commercial and recreational fisheries in Port Angeles Harbor and the Discovery Bay - Protection Island area. Non-human; food organism for many fish species including rockfish, cabezon, and perch.

General Location or Habitat Association of Resource: Most harvest occurs in waters 100 to 220 m deep, however, the coonstripe and spot prawn are found as shallow as the lower intertidal zone.

Seasonal Sensitivity: Planktonic larval phase from February through July.

Recommended Protection Strategy: Utilize beach clean up techniques that do not transport oil into shallow subtidal area.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

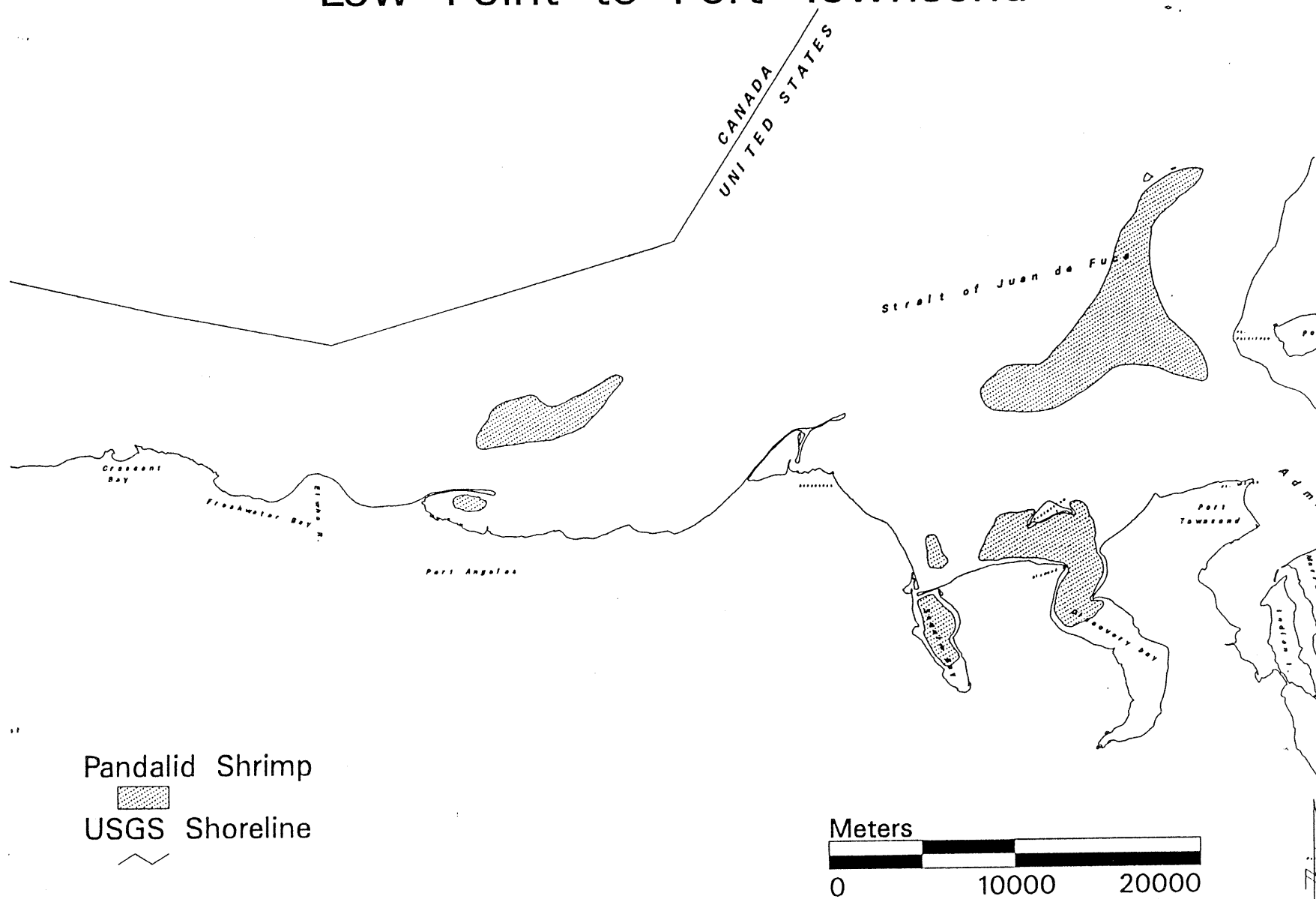
References:

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

Hueckel, G.J. 1980. Foraging on an artificial reef by three Puget Sound fish species. Wa. Dept. Fish. Tech. Rpt. 53. 110 p.

Strait of Juan de Fuca Shellfish Resources Low Point to Port Townsend

STRAIT OF JUAN DE FUCA GRP



March 15, 1996

6-65

Source: Washington Department of Fisheries
This map does not offer complete information on the distribution of fish and shellfish resources.
Comprehensive surveys have not been completed along all shorelines.

Puget Sound Fish and Shellfish Habitat Association Table - Key

Life Stages - eggs
 larvae
 juveniles
 spawners/spawning
 parturition (birth)
 adults

Timing - --- common
 +++ abundant
 *** highly abundant

Salinity Range - tidal fresh 0.0 - 0.5 ppt
 mixing 0.5 - 25.0 ppt
 seawater >25.0 ppt

Habitats - intertidal 0-3 m
 subtidal 3-10m

Data Source - Monaco, M.E. et al. 1990. Distribution and abundance of fishes and
 invertebrates in west coast estuaries. Vol. I: Data summaries.
 ELMR Rept. 4. Strategic Assessment Branch, NOS/NOAA, Rockville, MD

 Emmett, R.L. et al. 1991. Distribution and abundance of fishes and
 invertebrates in west coast estuaries. Vol. II: Species Life
 History Summaries. ELMR Rept. 8. Strategic Assessment Branch,
 NOS/NOAA, Rockville, MD

March 15, 1996

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Fish Habitat Association in Puget Sound

Species	Timing	Salinity Range			Substrate Preference									Habitats							
														Type			Area				
		Tidal	Fresh	Mixing	Sea water	Mud / Silt / Clay	Sand / Granule	Pebble	Cobble	Boulder / Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Spring Chinook Salmon	J F M A M J J A S O N D																				
	juveniles	-----+	X	X	X		X	X	X								X	X	X	X	X
	adults	-----+	X	X	X		X	X	X								X	X	X	X	X
Fall Chinook Salmon	J F M A M J J A S O N D																				
	juveniles	-----+	X	X	X		X	X	X								X	X	X	X	X
	adults	-----+	X	X	X		X	X	X								X	X	X	X	X
Sockeye Salmon	J F M A M J J A S O N D																				
	juveniles	-----+	X	X	X									X			X	X	X	X	X
	adults	-----+	X	X	X		X	X									X	X	X	X	X
Coho Salmon	J F M A M J J A S O N D																				
	juveniles	-----+	X	X	X		X	X									X	X	X	X	X
	adults	----+-----	X	X	X		X	X									X	X	X	X	X
Chum Salmon	J F M A M J J A S O N D																				
	juveniles	-----+	X	X	X									X			X	X	X	X	X
	adults	++-----+-----	X	X	X		X	X									X	X	X	X	X

March 15, 1996

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Fish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference										Habitats					
															Type			Area		
		Tidal Fresh	Mixing	Sea water	Mud / Silt / Clay	Sand / Granule	Pebble	Cobble	Boulder / Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Pink Salmon		J F M A M J J A S O N D																		
	juveniles	++++*****-----	X	X	X								X			X	X	X	X	X
	adults	---+*****--	X	X	X		X	X								X	X	X	X	X
Surf Smelt		J F M A M J J A S O N D																		
	eggs	*****		X	X		X							X						
	larvae	++++*****		X	X		X							X						
	juveniles	++++*****		X	X								X			X	X	X	X	X
	spawners	*****		X	X		X							X						
	adults	++++*****		X	X								X			X	X	X	X	X
Herring		J F M A M J J A S O N D																		
	eggs	*****		X	X						X	X		X	X					X
	larvae	*****++		X	X								X			X	X	X	X	X
	juveniles	++++*****		X	X								X			X	X	X	X	X
	spawners	*****		X	X						X	X		X	X					X
	adults	*****		X	X								X			X	X	X	X	

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Fish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference										Habitats					
															Type			Area		
		Tidal Fresh	Mixing	Seawater	Mud/Silt/Clay	Sand/Granule	Pebble	Cobble	Boulder/Rippap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Longfin Smelt		J F M A M J J A S O N D																		
	eggs					X											X			
	larvae	----- ---	X	X	X	X										X	X	X	X	
	juveniles	-----		X	X								X			X	X	X	X	
	adults	----- ---	X	X	X								X			X	X	X	X	
Anchovy		J F M A M J J A S O N D																		
	eggs	--		X	X								X			X				
	larvae	----		X	X								X			X	X	X	X	
	juveniles	-----		X	X								X			X	X	X	X	
	spawners	----		X	X								X			X				
	adults	-----		X	X								X			X	X	X	X	
Sand Lance		J F M A M J J A S O N D																		
	eggs	+++++++ +++		X	X		X							X	X	X	X			
	larvae	+++++++		X	X		X									X	X			
	juveniles	+++++++		X	X		X							X	X	X	X			
	spawners	+++++++ +++		X	X		X							X	X	X	X			
	adults	-----		X	X		X							X	X	X	X			

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Fish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference										Habitats						
		Tidal	Fresh	Mixing	Sea water	Mud / Silt / Clay	Sand / Granule	Pebble	Cobble	Boulder / Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Type			Area			
															Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
English Sole	J F M A M J J A S O N D																				
	eggs ***** +				X									X							
	larvae +++++++			X	X	X								X			X	X	X		
	juveniles *****			X	X	X	X					X	X		X	X		X	X	X	X
	spawning ++++++++ +			X	X	X	X									X					
	adults ++++++++			X	X	X	X					X	X			X		X			
Starry Flounder	J F M A M J J A S O N D																				
	eggs -----				X									X			X				
	larvae -----			X	X									X			X	X			
	juveniles -----+++++	X		X	X	X	X					X	X		X	X		X	X	X	X
	spawning --+-----				X		X														
	adults ++++++++			X	X	X	X					X	X		X	X		X	X		
Ling Cod	J F M A M J J A S O N D																				
	eggs ----- -				X					X	X				X	X					
	larvae -----			X	X									X			X				
	juveniles -----			X	X	X	X			X	X	X	X		X	X		X	X	X	
	spawning ----- -				X					X	X				X	X					
	adults -----				X					X	X		X		X	X					

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Fish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference										Habitats					
															Type			Area		
		Tidal Fresh	Mixing	Seawater	Mud/ Silt/ Clay	Sand/ Granule	Pebble	Cobble	Boulder/ Riprap	Rocky Outcrop	Estuarine veg	Marine veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Shiner Perch		J F M A M J J A S O N D																		
	juveniles	+++++*****	X	X	X	X	X				X		X		X	X	X	X	X	X
	parturition	---+---		X		X	X				X		X				X	X	X	X
	adults	*****		X	X	X	X				X		X		X	X	X	X	X	X
Perch		J F M A M J J A S O N D																		
	juveniles	+++++++	X	X	X	X	X				X					X	X	X	X	X
	parturition	---+---		X	X	X	X				X						X	X	X	X
	adults	---+---		X	X	X	X				X					X	X	X	X	X
Pacific Tomcod		J F M A M J J A S O N D																		
	larvae	-----		X	X								X				X	X	X	
	juveniles	-----+-----		X	X	X	X				X	X			X		X	X	X	
	adults	+++++		X	X	X	X								X		X	X	X	

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Shellfish Habitat Association in Puget Sound

Shellfish Habitat Association in Puget Sound																					
Species	Timing	Salinity Range			Substrate Preference										Habitats						
															Type			Area			
		Tidal	Fresh		Mud / Silt / Clay	Sand / Granule	Pebble	Cobble	Boulder / Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat	
Dungeness Crab	J F M A M J J A S O N D																				
eggs	-----																				
larvae	-----			X	X								X			X	X	X			
juveniles	-----+*****--			X	X	X	X	X				X			X	X		X	X	X	
mating	-----														X	X					
adults	+++++			X	X	X	X	X							X	X		X	X	X	
Blue Mussel	J F M A M J J A S O N D																				
eggs	+++++			X	X								X			X	X	X	X	X	
larvae	+++++			X	X								X			X	X	X	X	X	
juveniles	*****			X	X				X	X	X				X	X		X	X	X	
spawning	+++++			X	X								X	X	X		X	X	X	X	
adults	*****			X	X				X	X	X				X	X		X	X	X	
Softshell Clam	J F M A M J J A S O N D																				
eggs	+++++			X	X								X			X	X	X	X	X	
larvae	+++++			X	X								X			X	X	X	X	X	
juvenile	+++++			X	X	X	X								X	X		X	X	X	
spawning	+++++			X	X								X	X	X		X	X	X	X	
adults	+++++			X	X	X	X								X	X		X	X	X	

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Shellfish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference										Habitats						
															Type			Area			
		Tidal	Fresh	Mixing	Sea water	Mud / Silt / Clay	Sand / Granule	Pebble	Cobble	Boulder / Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Pacific Gaper Clam	J F M A M J J A S O N D																				
eggs	+++++++			X	X									X			X	X	X	X	X
larvae	+++++++			X	X									X			X	X	X	X	X
juvenile	+++++++			X	X	X	X								X	X		X	X	X	X
spawning	+++++++			X	X										X	X		X	X	X	X
adults	+++++++			X	X	X	X								X	X		X	X	X	X
Horse Clam	J F M A M J J A S O N D																				
eggs	-----													X			X	X	X	X	X
larvae	-----			X	X									X			X	X	X	X	X
juvenile	+++++++			X	X	X	X								X	X		X	X	X	X
spawning	-----														X	X		X	X	X	X
adults	+++++++			X	X	X	X								X	X		X	X	X	X
Little Neck Clam	J F M A M J J A S O N D																				
eggs	*****													X			X	X	X	X	X
larvae	*****													X			X	X	X	X	X
juveniles	*****			X	X	X	X	X	X						X	X		X	X	X	X
spawning	*****													X	X	X		X	X	X	X
adults	*****			X	X	X		X	X						X	X		X	X	X	X

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Shellfish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference									Habitats							
														Type			Area				
		Tidal	Fresh	Mixing	Seawater	Mud / Silt / Clay	Sand / Granule	Pebble	Cobble	Boulder / Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Manila Clam	J F M A M J J A S O N D																				
	*****												X			X	X	X	X	X	X
	*****			X	X								X			X	X	X	X	X	X
	*****			X	X	X	X	X	X					X	X					X	X
	*****												X	X	X					X	X
	*****			X	X	X	X	X	X					X	X					X	X
Pacific Oyster	J F M A M J J A S O N D												X			X	X	X	X	X	X
													X			X	X	X	X	X	X
																X	X	X	X	X	X
	*****			X	X	X	X	X	X	X				X	X		X	X	X	X	X
	*****			X	X	X	X	X	X	X				X	X		X	X	X	X	X
Geoduck Clam	J F M A M J J A S O N D												X			X	X	X	X	X	X
	++++++			X	X								X			X	X	X	X	X	X
	++++++			X	X											X	X	X	X	X	X
	++++++			X	X	X	X							X	X		X	X	X	X	X
	++++++			X	X								X	X	X		X	X	X	X	X
	++++++			X	X	X	X							X	X		X	X	X	X	X

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